

**KNOWLEDGE, ATTITUDE, AND PRACTICE OF SODIUM SALT AND
ITS RELATIONSHIP WITH SODIUM SALT INTAKE AMONG
HYPERTENSIVE PATIENTS IN HOSPITAL PAKAR UNIVERSITI
SAINS MALAYSIA**

SHAHERAH BINTI ABD KHEDIR

UNIVERSITI SAINS MALAYSIA

2024

**KNOWLEDGE, ATTITUDE AND PRACTICE OF SODIUM SALT AND
ITS RELATIONSHIP WITH SODIUM SALT INTAKE AMONG
HYPERTENSIVE PATIENTS IN HOSPITAL PAKAR UNIVERSITI
SAINS MALAYSIA**

by

SHAHERAH BINTI ABD KHEDIR

Thesis submitted in fulfilment of the requirements
for the degree of
Bachelor of Health Science (Honours) Dietetics

2024

CERTIFICATE

This is to certify that Miss Shaherah Binti Abd Khedir's dissertation, "Knowledge, Attitude, and Practice of Sodium Salt and Sodium Salt Intake Among Hypertensive Patients in Hospital Pakar Universiti Sains Malaysia" is genuine record of research work done as a final year research project in dietetics under my supervision. I have reviewed this dissertation and believe that it meets acceptable academic presentation standards and its satisfactory in scope and quality as a dissertation to be submitted I partial fulfillment for the degree of Bachelor of Health Science (Honours) (Dietetics).

Main Supervisor,



Mrs. NurZetty Sofia Binti Zainuddin (Supervisor)

Lecturer

Dietetics Programme

School of Health Science

Universiti Sains Malaysia

Health Campus

16150 Kubang Kerian

Kelantan, Malaysia

DECLARATION

I hereby certify that this dissertation is indeed the outcome of my own research except when otherwise mentioned and officially acknowledged. I further certify that it has not previously or simultaneously been submitted in its entirety for any other degree at Universiti Sains Malaysia or any other institution. I authorize Universiti Sains Malaysia permission to utilize my dissertation for teaching, research, and promotion.

Student,



Shaherah Binti Abd Khedir

Final Year Dietetics Student
School of Health Sciences
Universiti Sains Malaysia
Health Campus
16150 Kubang Kerian
Kelantan, Malaysia

ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious, the Most Merciful, Alhamdulillah ala Kulli Haal (all praise is due to Allah) for granting me the opportunity to complete this Final Year Project which is title Knowledge, Attitude and Practice of Sodium Salt and Its Relationship with Sodium Salt Intake Among Hypertensive Patients in Hospital Pakar Universiti Sains Malaysia.

Completing this final year project has been significant milestone in my academic journey, and it would not have been possible without the guidance, support, and encouragement of many individuals. I am grateful to each of them for their invaluable contributions. First and foremost, I would like to express my heartfelt gratitude to my research supervisor Madam NurZetty Sofia Binti Zainuddin, a lecturer at School of Health Science USM who had guided me during this research journey. Your expert guidance, insightful feedback, and continuous support have been instrumental in shaping the direction of this research. Your patience and encouragement have inspired me to persevere through the challenges and strive for excellence.

I extend my deepest thank to the lecturers, dietitians of Dietetics USM, and all the staffs at selected clinics and wards at Hospital Universiti Sains for their cooperation and providing me with the necessary resources and a conducive environment to carry out my research. The support from the staff and dietitians has been integral to the successful completion of this project. Not to forget, a deepest thanks to all my kindest patients for their invaluable participation in research study. Your willingness to share your experiences, insights, and time has been instrumental in advancing our understanding this research.

To my parents, family, my best friends, and my classmates your unwavering support and encouragement have been my greatest source of strength and thank you for always being there for me from the beginning till the end throughout this journey of research. Your love and belief in me have kept me motivated and focused.

Last but not least, I dedicate this achievement to my dearest self, thank you for your resilience and for never giving up.

Table of Contents

CERTIFICATE.....	iii
DECLARATION	iv
ACKNOWLEDGEMENT.....	v
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF SYMBOLS	xi
LIST OF ABBREVIATION	xii
LIST OF APPENDICES	xiii
ABSTRAK	xiv
ABSTRACT.....	xv
CHAPTER 1: INTRODUCTION.....	16
1.1 Background of the study	16
1.2 Problem statement.....	18
1.3 Study Rationale.....	19
1.3 Research Questions.....	20
1.4 Research Objective.....	20
1.4.1 General Objective.....	20
1.4.2 Specific objective	20
1.5 Research Hypothesis.....	21
CHAPTER 2: LITERATURE REVIEW	22
2.1 Prevalence of Hypertension in Malaysia.....	22
2.2 Functions of Sodium	23
2.3 Sources of Dietary Sodium	23
2.4 Sodium Intake Among Malaysian Adults	24
2.5 Knowledge, Attitude, and Practice of Sodium in Malaysia.....	25
2.6 Factors Affecting KAP on Sodium Salt	26

2.7 Factors affecting Dietary Sodium Intake.....	27
2.8 Methods in Quantifying Sodium Intake.....	28
2.9 Relationship of KAP on sodium salt and dietary sodium intake	30
2.10 Conceptual Framework	32
CHAPTER 3: RESEARCH METHODOLOGY	33
3.1 Study Design.....	33
3.2 Study Area	33
3.3 Study Population.....	33
3.4 Subject Criteria	34
3.5 Sample Size Calculation	34
3.6 Sampling Method and Subject Recruitment.....	36
3.7 Research Tool	36
3.7.1 Part 1: Socio-demographic information.....	37
3.7.2 Part 2: Knowledge, Attitude, and Practice	37
3.7.3 Part 3: Food Frequency Questionnaire on sodium	39
3.8 Operational Definition	40
3.9 Data Collection Method.....	40
3.10 Study Flow Chart.....	43
3.11 Research Variable	44
3.12 Data Analysis	44
3.13 Ethical Issues	45
CHAPTER 4: RESULTS	47
4.1 Sociodemographic data.....	47
4.2 Responses of Knowledge, Attitude, and Practice on sodium salt intake from hypertensive patients.....	48
4.3 Scoring of KAP on sodium salt	52
4.4 Dietary sodium salt intake among hypertensive patients in Hospital Pakar USM	54
4.5 Association between Knowledge, Attitude, and Practice on Sodium with Dietary Sodium Intake among hypertensive patients in Hospital Pakar USM.	56
4.6 Correlation between Knowledge, Attitude, & Practice on Sodium and Dietary	

Sodium Salt Intake.....	57
CHAPTER 5: DISCUSSION	58
5.1. Sociodemographic characteristics.....	58
5.2 Association between Knowledge, Attitude, and Practice on Sodium Salt and Dietary Sodium Intake among hypertensive patients in Hospital Pakar USM.	59
CHAPTER 6: CONCLUSION	65
6.1 Conclusion	65
6.2 Limitation and recommendation.....	66
8.0 APPENDICES.....	76
Appendix 1: Questionnaires Booklet (Malay Version)	76
Appendix 2: Questionnaires Booklet (English Version)	90
Appendix 3: Proof of Approval to Use Questionnaire.....	102
Appendix 4: Poster for Subject’s Recruitment.....	103
Appendix 5: Approval form Hospital Pakar USM	<u>104</u>

LIST OF TABLES

	Page
Table 3.7.1: Part B of Questionnaire	38
Table 3.7.2: Percentage of KAP score according to domain.....	39
Table 4.1.1: Socio demographic details of respondents.....	47
Table 4.2.1: Question on Knowledge, Attitude, and Practice domain on sodium.....	50
Table 4.3.2: KAP mean score by Sociodemographic.....	53
Table 4.4.1: Dietary sodium intake by socio demographic details of respondents.....	55
Table 4.5.1: Association between KAP on sodium and dietary sodium intake.....	56
Table 4.5.2: Correlation between Knowledge, Attitude, and Practice and Dietary sodium intake.....	57

LIST OF FIGURES

	Page
Figure 2.10: Conceptual Framework.....	31
Figure 4.3.1: Frequency of KAP on sodium group by gender.....	52
Figure 4.5.1: Association between KAP on sodium and dietary sodium intake.....	56

LIST OF SYMBOLS

n	Sample size
Z	Value representing the desired confidence level
Δ	Precision
p	Anticipated population proportion
p	p -value

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ASN	American Society for Nutrition
BMI	Body Mass Index
CDRR	Chronic Disease Risk Reduction
CVD	Cardiovascular Disease
DOSM	Department of Statistic Malaysia
FFQ	Food Frequency Questionnaire
IPH	Institute for Public Health
KAP	Knowledge, Attitude, and Practice
MOH	Ministry of Health
NCD	Non-Communicable Disease
PhD	Doctor of Philosophy
PIS	Patient Information Sheet
RNI	Recommended Nutrient Intake
SES	Social Economy Status
SOP	Standard Operating Procedure
SPSS	Statistical Package for Social Sciences
USM	University Sains Malaysia
WHO	World Health Organization
HPT	Hypertensive patient
BP	Blood pressure
IPD	Inpatient Department
OPD	Outpatient Department

LIST OF APPENDICES

	Page
Appendix 1: Questionnaire Booklet included Form Participant Information Sheet & Consent Form (Malay version)	76
Appendix 2: Questionnaire Booklet included Form Participant Information Sheet & Consent Form (English version)	90
Appendix 3: Permission Request Letter Draft to Director of Hospital USM.....	102
Appendix 4: Proof of Approval to Use Questionnaire	103
Appendix 5: Poster for Subject's Requirement	104

**PENGETAHUAN, TINGKAH LAKU, DAN AMALAN PENGAMBILAN
GARAM SODIUM DAN HUBUNGANNYA DENGAN PENGAMBILAN
GARAM SODIUM DALAM DIET DALAM KALANGAN PESAKIT
DARAH TINGGI DI HOSPITAL PAKAR UNIVERSITI SAINS
MALAYSIA**

ABSTRAK

Sekurang-kurangnya satu daripada tiga orang dewasa Malaysia menghidap hipertensi di Malaysia, di mana, ianya merupakan penyumbang penting kepada penyakit kardiovaskular. Oleh itu, kajian keratan rentas ini bertujuan untuk mengetahui perkaitan Pengetahuan, Sikap, dan Amalan (KAP) terhadap pengambilan garam sodium dengan hipertensi dalam kalangan pesakit di Hospital Pakar Universiti Sains Malaysia (USM), Kubang Kerian, Kelantan. Kira-kira 120 peserta daripada Jabatan Pesakit Luar dan Pesakit Dalam Hospital Pakar USM telah mengambil bahagian dalam kajian ini. Majoriti peserta adalah perempuan (65.8%) dengan umur purata 53.62 (6.72) tahun. Para peserta telah direkrut menggunakan teknik sampel kemudahan bukan kebarangkalian dan dikehendaki menjawab soal selidik melalui temu bual bersemuka dengan persetujuan soal selidik yang disahkan sendiri dalam bahasa Melayu yang merangkumi maklumat sosiodemografi, pengetahuan, sikap dan amalan (KAP) terhadap garam sodium dan soal selidik kekerapan makanan (FFQ) mengenai garam sodium pemakanan. Signifikan telah ditetapkan sebagai $p < 0.05$. Oleh itu, skor KAP keseluruhan adalah purata (53.43%) dengan KAP yang rendah pada skor KAP sodium ≥ 2000 mg pengambilan garam sodium diet. Dalam kajian ini, tidak terdapat perkaitan yang signifikan ($p > 0.05$) antara KAP terhadap pengambilan garam sodium. Walau bagaimanapun, pesakit wanita mempunyai skor KAP yang lebih baik pada garam sodium ($p < 0.001$) dan pengambilan garam sodium ($p < 0.001$) berbanding lelaki. Selain itu, peserta yang tidak bekerja dan mempunyai pendapatan isi rumah yang rendah, mempunyai KAP yang lebih baik pada garam sodium ($p < 0.001$) dan kurang pengambilan garam sodium diet ($p < 0.001$). Kajian dan intervensi lanjut diperlukan untuk mengurangkan pengambilan garam sodium dalam kalangan pesakit hipertensi dan seterusnya mengurangkan risiko hipertensi.

**KNOWLEDGE, ATTITUDE, AND PRACTICE OF SODIUM SALT
INTAKE AND ITS RELATIONSHIP WITH SODIUM SALT INTAKE
AMONG HYPERTENSIVE PATIENTS IN HOSPITAL PAKAR
UNIVERSITI SAINS MALAYSIA**

ABSTRACT

At least one out of three Malaysian adults have hypertension in Malaysia, where, is a significant contributor to cardiovascular diseases. Therefore, this cross-sectional study was aimed to determine the association Knowledge, Attitude, and Practice (KAP) towards sodium salt intake with hypertension among patients in Hospital Pakar Universiti Sains Malaysia (HPUSM), Kubang Kerian, Kelantan. About 120 participants from Outpatient and Inpatient of HPUSM was participated in this study. The majority of participants were females (65.8%) with mean age of 53.62(6.72) years old. The participants were recruited using non-probability convenience sample technique and required to answer the questionnaire via face to face interview with an informed consent a self-administrated validated questionnaire in Malay language that included sociodemographic information, knowledge, attitude, and practice (KAP) toward sodium and food frequency questionnaire (FFQ) on dietary sodium. The significant was set as $p < 0.05$. Therefore, overall KAP score was poor (53.43%) with poor KAP on sodium of ≥ 2000 mg dietary sodium intake. In this study, there were no significant ($p > 0.05$) associations between KAP on salt intake with sodium intake. However, female patients had better KAP score on sodium ($p < 0.001$) and sodium intake ($p < 0.001$) compared to male. Also, unemployed and low household income participants had better KAP on sodium ($p < 0.001$) and dietary sodium salt intake ($p < 0.001$). Further study and interventions are needed to reduce the salt intake among hypertensive patients and thus reduce the risk of hypertension.

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Sodium is an essential nutrient, which means it is required for normal body function and health, and as with other essential electrolytes (Lowell, 2019) and we need 0.23 to 0.46 g/day to fulfill the body's physiological needs (Institute for Public Health (IPH), 2016). High intake of salt or sodium is linked to a number of harmful health effects, one of which is a positive causal relationship with blood pressure (BP) (Malta *et al.*, 2018). Due to this evidence, the World Health Organization (WHO) recommended dietary salt intake for adults to be less than 2000 mg/day of sodium, which is equivalent to less than 5 g/day of salt (less than a teaspoon). For children, however, the adult dose was adjusted downward based on their energy requirements (Malta *et al.*, 2018).

According to the World Health Organization (WHO), hypertension affects approximately 1.13 billion people globally and is diagnosed in 1 in 4 men and 1 in 5 women (Ismail *et al.*, 2023). The NCD Risk Factor Collaboration's 2017 study indicates that Asian countries, particularly low-income countries, are at risk of becoming hypertension epidemics (Zhou *et al.*, 2017). Malaysia having a higher prevalence of 22.9% is reported to be higher than its neighbouring countries, i.e., Singapore (14.6%) and Thailand (22.3%) (Ho *et al.*, 2020). In Malaysia, hypertension prevalence rises with age, reaching 8.6% in the (18-29 age group), 27.9% in the (40-49 age group), 13.5% in the (30-39 age group), and 33.2% in the (40-59 age group) (Ho *et al.*, 2020). Meanwhile, the most recent National Health and Morbidity Survey (NHMS) data from 2019, the prevalence of hypertension in Malaysia was 30.0%. This represents a slight decrease from the results of the NHMS 2015 (30.3%) and NHMS 2011 (32.6%) that were previously released (Ismail *et al.*, 2023). Whereby, the prevalence of hypertension in Kelantan was 13.9% is common disease in Kelantan and is associated with multiple risk factors for cardiovascular disease (Mafauzy *et al.*, 2003). As wealth rises, the prevalence is expected to rise in the near future and develop into a serious health issue (Mafauzy *et al.*, 2003).

The MySalt Study from Institute for Public Health (IPH), (2016) reported that

employees of the Malaysian Ministry of Health consumed 2860 mg of sodium per day from 24-hour urine analysis and 3393 mg per day from a food frequency questionnaire (FFQ). Hence, the majority of Malaysian adults consumed a high proportion of sodium consumption which is ≥ 2000 mg/day (79%), and only 21% consumed < 2000 mg/day (IPH, 2019). WHO set a global goal to reduce dietary salt intake by 30% by 2025 in order to prevent and manage noncommunicable diseases linked to excessive salt consumption. Numerous nations have already implemented salt reduction programs (Malta *et al.*, 2018). WHO recommends cutting sodium by 2000 mg/day (equivalent to less than 5g/day salt), with Malaysia incorporating this into its salt intake guidelines, and committing to 30% global salt reduction by 2025 (IPH, 2016).

Excessive intake of salt in the diet can be attributed to a variety of circumstances. For instance, it has been established that social, cultural, age, income, and educational attainment all affect how much salt a person consumes. The majority of adult respondents to the Malaysian Community Salt Survey (MyCoSS) (2021) had a good understanding of salt intake (83.0%), while some respondents (17%) lacked basic exposure to knowledge about hypertension and salt intake (Cheong *et al.*, 2021). Even with this knowledge, 60.9% of participants claimed that cutting back on salt was insignificant. Moreover, about 30.0% of participants reported not regularly controlling their sodium or salt intake. Even worse, hypertension was identified in the majority of those who did not restrict their intake of salt (Cheong *et al.*, 2021). The study by Haron *et al.*, (2021) also produced a similar finding, showing that while the participants had a favorable attitude toward a healthy salt intake, their knowledge and practices about salt were inadequate and unsatisfactory.

Salt intake was influenced by an individual's knowledge, attitude and practice (KAP) on salt intake (Haron, 2022). People continue to consume excessive sodium intake due to lack of awareness about the effect of excessive sodium intake towards hypertension (Jiang *et al.*, 2023). KAP is a functional tool targeted as a baseline assessment for intervention at population level. As a result, since hypertension is an emerging worldwide issue, figuring out the level of KAP and its relationship to dietary sodium intake is essential to developing intervention strategies and policies on reduction of sodium intake. Thus, the purpose of this study was to comprehend and evaluate the variables influencing the adults who are hypertensive patients at Hospital Pakar Universiti Sains Malaysia's knowledge, attitude, and practice of sodium salt and sodium salt consumption on dietary salt intake.

1.2 Problem statement

According to Ho *et al.*, (2020), hypertension in Malaysia has shown a gradually increasing tendency over the previous few decades, with 16.2% in the first decade (1980–1989), 36.8% in the second decade (1990–1999), and inconsistent results with 28.7% in the third decade (2000–2009) and 26.8% in the fourth decade (2010–2018). Furthermore, it is widely recognized that hypertension poses a significant risk for cardiovascular disease (CVD), which is Malaysia's leading cause of death (Department of Statistics Malaysia (DOSM), 2021). The development of high blood pressure is significantly influenced by excessive dietary sodium consumption. Consuming too much salt increases blood pressure, which is the leading cause of death in Malaysia (IPH, 2019). Moreover, the majority of Malaysians adopted sedentary lifestyles and consumed high-calorie, salty, and fatty foods, which contributed to the growth in hypertension and other non-communicable diseases (NCDs) and modernisation (Khor, 2012).

The Ministry of Health has taken the initiative in developing the National Strategy Plan for Non-Communicable Disease (2016–2025) to battle NCDs in order to address the issue of hypertension in Malaysia. Nonetheless, there was still a lack of awareness, treatment, and control over hypertension among Malaysians. Only one-third of those receiving treatment were able to get their blood pressure under control, and five out of ten persons were aware that they had hypertension (Ho *et al.*, 2020). Previous studies have demonstrated that adults are more likely to contribute to the development of hypertension in their later years, as demonstrated by inadequate KAP levels and high salt consumption (Haron *et al.*, 2021).

As a result, knowledge, attitude, and practice (KAP) assessments were a useful method for learning about the individual factors that influence people's eating habits (Fautsch Macías *et al.*, 2014). A person's health will be significantly improved by having a better understanding of nutrition and the risk factors associated with hypertension, leading to a healthy pattern of salt intake (Haron *et al.*, 2021). Therefore, the purpose of this study is to evaluate the amount of sodium consumed by adults at Hospital Pakar Universiti Sains Malaysia as well as to ascertain the relationship between knowledge, attitude, and practice (KAP) regarding sodium salt. Higher levels of understanding, attitudes, and behaviours are expected to determine dietary sodium intake in accordance with recommendations.

1.3 Study Rationale

The primary cause of the CVD epidemic is the rising prevalence of CVD risk factors, including hypertension which is a primary cause of death (Firus Khan *et al.*, 2022). Since hypertension is an emerging worldwide issue, gathering epidemiological data and evaluating a population's knowledge, attitudes, and practices regarding a healthy salt intake are critical to developing successful salt-reduction strategies (Leyvraz *et al.*, 2018). Hence, the key finding for this study are to increase the health education and awareness about the risks associated with high sodium intake and the importance of dietary changes for hypertensive individuals.

The understanding of the effects of sodium on human health, as well as the behavior of controlling salt intake, is critical to lowering the prevalence of hypertension among Malaysians (Baharudin *et al.*, 2021). As a previous study reported, eating habits high in salt were associated with poor control of hypertension in Malaysians (Mahat *et al.*, 2017). It was stated that Malaysians' high sodium intake was caused by their lack of awareness and practice about lowering their salt intake (Mahat *et al.*, 2017). Therefore, by assessing the attitudes and practices of hypertension patients regarding sodium intake, the factors that contribute to unhealthy behaviours can be identified. These interventions may include counseling, educational materials, or support groups to help hypertensive individuals adopt healthier dietary habits.

Research on KAP can provide insights into specific needs and challenges faced by hypertensive patients in managing their sodium intake. Therefore, understanding the relationship between KAP and sodium intake can contribute to the prevention and management of hypertension. By addressing knowledge gaps and promoting positive attitudes and practices, healthcare professionals can empower hypertensive individuals to make informed decisions about their dietary choices, ultimately contributing to better blood pressure control and overall cardiovascular health. Hypertension is a major risk factor for cardiovascular diseases, and dietary factors, including sodium intake, play a crucial role in its management. By improving the knowledge, attitudes, and practices of hypertensive patients, there is potential to reduce the overall burden of hypertension-related health care costs.

As a result, the finding of this study provided informations about knowledge, attitudes, and practices (KAP) level of sodium and their association between dietary sodium intake among adults in Hospital Pakar Universiti Sains Malaysia. Hence, the results of KAP with regard to sodium intake can be utilised to develop plans for individual practice modifications with regard to dietary sodium intake (Haron, 2022b).

1.3 Research Questions

1. What is the knowledge, attitudes, and practices (KAP) score on sodium salt among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM)?
2. What is the average dietary sodium intake among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM)?
3. Is there any association between Knowledge, Attitudes, and Practices (KAP) score on sodium salt and dietary sodium intake among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM)?

1.4 Research Objective

1.4.1 General Objective

To determine the association of knowledge, attitude, and practice (KAP) on sodium salt and sodium salt intake among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM)?

1.4.2 Specific objective

- i. To identify the score of knowledge, attitude, and practice (KAP) of sodium salt among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).
- ii. To identify the average intake of dietary sodium among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

- iii. To determine the association between knowledge, attitudes, and practices (KAP) on sodium salt with dietary sodium intake among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

1.5 Research Hypothesis

1.5.1 Null Hypothesis (H_0)

There is no significant association between knowledge, attitudes, and practices (KAP) on sodium salt and dietary sodium intake among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

1.5.2 Alternative Hypothesis (H_A)

There is a significant association between knowledge, attitudes, and practices (KAP) on sodium salt and dietary sodium intake among hypertensive patients in Hospital Pakar Universiti Sains Malaysia (HPUSM).

CHAPTER 2: LITERATURE REVIEW

2.1 Prevalence of Hypertension in Malaysia

Over the past few decades, Malaysia has seen a steady rise in hypertension: from 16.2% in the first decade (1980–1989) to 36.8% in the second (1990–1999), 28.7% in the third (2000–2009), and 26.8% in the fourth (2010–2018), the rise has been consistent (Ho *et al.*, 2020). According to a report, Malaysia has a higher prevalence of hypertension (22.9%) than its neighbouring countries, Singapore (14.6%) and Thailand (22.3%) (Haron *et al.*, 2021). Epidemiological studies show that the prevalence of hypertension increases with age (Ho *et al.*, 2020). In Malaysia, the prevalence of hypertension was found to be 8.6% among individuals 18 to 29 years old, among those 40 to 49 years old, the rate more than doubled to 27.9%, compared to 13.5%) among those 30-39 years old. In the older age group, there was a comparable increase, with 63.1% of those over 60 years old (33.2%) (Ho *et al.*, 2020). Moreover, the Department of Statistics Malaysia regularly recognize cardiovascular disease (CVD) as the primary cause of death in Malaysia, and hypertension is a known risk factor for CVD (DOSM, 2021).

Therefore, the Ministry of Health established the Salt Reduction Strategy to Prevent and Control NCD for Malaysia (2015-2020) in 2015 as part of the National Strategic Plan for Noncommunicable Diseases (2016-2025). This method's three main initiatives are products (P), awareness (A), and monitoring (M). In order to reduce salt intake by 15% by 2020, it also includes the activities related to each and the stakeholders responsible for putting them into practice (IPH, 2016). According to IPH, (2019), adults in Malaysia consume 3.17 grams of salt on average per day, which is 1.17 grams more than is advised, with majority (55.4%) is aware but nearly half (47.7%) still add extra salt to their food. Despite an unfavorable trend in dietary sodium intake among Malaysian adults, hypertension and its associated variables remain poorly understood (Ho *et al.*, 2020).

2.2 Functions of Sodium

Sodium is necessary not only for fluid balance, but also for a variety of other bodily functions. As the most prevalent cation in extracellular fluid (ECF), sodium is an essential nutrient for preserving acid-base equilibrium, neuronal transmission, plasma volume, and optimal cell function. (WHO, 2012). The primary cation in extracellular fluid is sodium [ECF² (1 mmol, or molar equivalent, which is equivalent to 23 mg of sodium)]. An essential nutrient, sodium is involved in blood pressure (BP), fluid and electrolyte balance, and the preservation of normal cellular homeostasis (Strazzullo *et al.*, 2014). Due to its significant osmotic action, it plays a critical role in maintaining ECF volume (Strazzullo *et al.*, 2014). In addition, it is essential for the movement of nutrients and substrates across plasma membranes and for the excitability of nerve and muscle cells (Strazzullo *et al.*, 2014).

Average sodium content for an adult male is 92g, comprising 35g in the skeleton, 11g in intracellular fluid, and 46g in ECF (Strazzullo *et al.*, 2014). It is essential for nutrient transport, muscle and nerve cell excitability, and ECF volume maintenance (Strazzullo *et al.*, 2014). Therefore, water retention, an increase in systemic peripheral resistance, changes in endothelial function, changes in the structure and function of large elastic arteries, changes in sympathetic activity, and autonomic neuronal modulation of the cardiovascular system are all linked to high sodium intake and an increase in blood pressure (Grillo *et al.*, 2019).

2.3 Sources of Dietary Sodium

The sources of sodium intake can be divided into "discretionary" (form salt added to food at the table or in the kitchen) and "nondiscretionary" (sodium added during industrial food transformation and naturally occurring in foods) (Strazzullo *et al.*, 2014). The latter group mainly consists of sodium chloride, with less than 0.10 g coming from sodium glutamate, bicarbonate, and other compounds. Foods vary greatly in their sodium concentration depending on two factors: the meal's source (animal foods, for example, naturally contain more salt) and the level of processing the item has undergone. With a few notable exceptions, the natural content of salt in fruit, vegetables, oils, and cereals ranges from traces to 20 mg/100 g.

Naturally, 40–120 mg/100 g are found in meat and seafood products; however, some shellfish, including mussels and oysters, can have up to 500 mg/100 g, and whole milk has about 50 mg/100g (Strazzullo *et al.*, 2014). It is evident that the amount of salt that is added during the production process affects the sodium content of processed meals. Rather than salt added to home cooking or even salt sprinkled on the table before dining, professionally prepared meals account for the majority of the sodium in our diets (CDC, 2019).

2.4 Sodium Intake Among Malaysian Adults

In Malaysia, 21% of adults ingested less than 2000 mg of salt per day, whereas 79% of adults consumed a high proportion of ≥ 2000 mg/day. An adult Malaysian takes in 3.17 g of sodium on average daily, 1.17 g more than the recommendation (IPH, 2019). Only 55.4% regularly check how much sodium they consume, and 47.7% tend to oversalt their cuisine (IPH, 2019). Adults in Malaysia consumed an average of 7.9 grams, or 1.5 teaspoons, of salt daily. The Ministry of Health Malaysia personnel reported 2860 mg/day of sodium from a 24-hour urine analysis and 3393 mg/day of sodium from a meal frequency questionnaire, or 7.15 gm of salt per day, according to the MySalt Study. This is higher than the recommendation of 2000 mg/day of sodium (IPH, 2016) and less than 5 gram/day of salt. The finding of a 2012 study by Rashidah *et al.*, (2014) among normotensive health workers in Malaysia found that 3429 mg/day, or 8.0 grams of salt per day (1.75 teaspoon), also exceeded the recommendation of sodium intake. The results show that 52.1% of adult Malaysians eat more sodium than is advised (Cheong *et al.*, 2021).

Singaporeans consume 3.6 g of sodium on average daily compared to the neighbouring country, as per the National Nutrition Survey 2018/19 (Ministry of Health Singapore (MOH), 2022). Additionally, this exceeds the WHO's suggestion that individuals consume no more than 2 grams of sodium each day. The average sodium consumption of American individuals often surpasses recommended levels. The Chronic Disease Risk Reduction (CDRR) consumption of more than 2,300 mg per day of sodium was recently created due to correlations between the risk of hypertension and excessive sodium intake. According to Clarke *et al.*, (2021) the proportion of 19-year-olds in the US who consumed more than 2,300 mg of salt daily varied between 2011–2012 and 2015–2016 (86.7%).